cepts of Physical Science'; III., 'The General Principles Relating to Matter,' and IV., 'The General Principles Relating to Energy.' To these are added a good general index.

The basal importance of the subjects with which these chapters have to do is well established and the author has achieved a signal success in the clear and comprehensive manner in which he has presented them to the reader.

For this is no rehash of what has been already well said by various authors on these subjects, but is clearly the result of a close personal inquiry into the underlying concepts of modern science. The reader is thus not infrequently asked to set aside the traditional form in which some concept has been hitherto expressed. The author's independence of thinking is well illustrated in his treatment of compounds and mixtures, kinetic and gravitational energy and the second law of thermodynamics.

Sometimes, however, an impression is left on the reader that the author's restatements of old laws are a little hasty and so lack the absolute singleness of idea or exact precision which should characterize any general statement in physical science.

Thus on page 117 we find Faraday's laws of electrolysis expressed as follows: '*The passage of electricity through an electrolyte is attended at each electrode by a chemical change involving a number of chemical equivalents strictly proportional to the quantity of electricity passed through, and dependent on that alone.*' This is hardly free from possible misunderstanding. A clearer statement of the facts, following the suggestion of the author, would be the following: The passage of electricity through any electrolyte is attended by chemical *changes* which involve the *same* number of chemical equivalents at each electrode, and which are directly proportional to the quantity of electricity passed through and dependent on that alone.

Similarly on page 37 the statement of the law of multiple proportion would be clearer if the words *the same* were replaced by the words *a given,* so that the law would read: 'When one element combines with another in several proportions to form different chemical compounds, the quantities of the one element which in the several compounds are combined with *a given* quantity of the other element, stand to one another in the ratio of small whole numbers.'

The chapter on energy is especially valuable. Throughout, the concept of energy is regarded as fundamental and the concept of force is made secondary. The treatment of the various forms of energy is such as to bring into prominence the factors of a particular form of energy—namely the *intensity* and *quantity* factors.

The first and second laws of thermodynamics or energetics, as our physical chemistry friends are pleased to call them, are presented and discussed with great distinctness.

Credit also should be given the author for his consistent use throughout the book of a particular and distinct symbol or letter to denote a particular and distinct physical quantity. This saves the beginner many pains. Beginners will owe him also much gratitude because he has made such free use of numerical examples to illustrate the applications of the various principles.

It is a pleasure to say that the present introductory volume is a positive addition to the literature of physical science and the students of physical chemistry, especially in America, will await with eagerness the appearance of the volumes which are to follow.

E. H. LOOMIS.

PRINCETON UNIVERSITY,
December, 1903.

SCIENTIFIC JOURNALS AND ARTICLES.

THE December number of the *Bulletin of the American Mathematical Society* contains: Report of the Boston Colloquium of the American Mathematical Society, by F. N. Cole; 'Linear systems of curves upon algebraic surfaces,' by H. S. White; 'An expression of certain known functions as generalized hypergeometric functions,' by E. T. Whittaker; 'On the factoring of large numbers,' by F. N. Cole; 'Note on the p-discriminant of ordinary linear differential equations,' by Arnold Emch; 'Hydrodynamic action at a distance,' by E. B.

Wilson; Shorter Notices of Braunmühl's 'History of Trigonometry' and of the recent reprint of Carnot's 'Treatise on heat engines' (1824); Notes; New Publications.

The January number of the *Bulletin* contains: Report of the October meeting of the American Mathematical Society, by F. N. Cole; 'Two systems of subgroups of the quaternary abelian group in the general Galois field,' by L. E. Dickson; 'The determination of the constants in the problem of the brachistochrone,' by Oskar Bolza; 'On three types of surfaces of the third order regarded as double surfaces of translation,' by A. S. Gale; 'On the generation of finite from infinitesimal transformations—a correction,' by H. B. Newson; Review of Study's Geometry of dynames, by Virgil Snyder; Review of Weber and Wellstein's Encyklopädie der Elementar-Mathematik, by D. E. Smith; Shorter Notices of the mathematical papers of the late George Green, Agnes M. Clerke's problems in Astrophysics, Müller and Presler's Constructive geometry, and Schilling's Catalogue of mathematical models; Notes; New Publications.

SOCIETIES AND ACADEMIES.

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE.

THE fourth regular meeting of the Society for Experimental Biology and Medicine was held in the demonstration room of the department of physiology of Columbia University, at the College of Physicians and Surgeons, on Wednesday evening, December 16. Dr. S. J. Meltzer presided.

Reports of original investigations were offered as follows:

*The Changes in the Viscosity of the Blood Produced by Various Experimental Procedures, with Demonstrations:** R. BURTON-OPITZ.

Dr. Burton-Opitz described and demonstrated the apparatus used in determining the viscosity of the blood. This demonstration was followed by a discussion of the changes in

* The abstracts here given have been prepared by the authors themselves. The secretary has made only a few abbreviations and minor changes.

the molecular friction of the blood after intravenous injections of distilled water, saline, dextrose and alcoholic solutions. The effect of alcohol, when introduced into the stomach and small intestine, was also noted. Next were considered the changes following subcutaneous administration of curare and the differences in the viscosity of arterial and venous blood. K, the coefficient expressing the viscosity was determined before and after each experimental procedure, two or three determinations being made in each case.

It was found that, if distilled water, in quantities of from 5 to 50 c.c., is slowly allowed to flow into the facial vein, the viscosity of the blood is increased, but the increase is not considerable. The following experiment may serve as a sample. The normal coefficient K, in a dog weighing 19.2 kilos, was 802.6, or 5.8 times greater than K for distilled water at 37° C. After the injection of 10 c.c. distilled water the coefficient showed the value 786.0, or 6.0 times greater than distilled water at 37° C. Normal saline solutions produce the reverse effect, *i. e.*, the blood becomes less viscous. In one case after injecting 10 c.c. of 0.7 per cent. NaCl solution, the viscosity of the blood fell from 5.9 to 5.6 times that of distilled water at 37° C. Concentrated solutions of dextrose (5 c.c.) injected into the facial vein bring about an increase in the viscosity of the blood which is more pronounced than that produced by distilled water. About half an hour after the injection the coefficient K shows again its normal value.

If from 3 to 5 c.c. of 10 or 25 per cent. solutions of alcohol in water are allowed to flow into the facial vein, the molecular friction of the blood becomes greater. The same result can be obtained by introducing the alcohol directly into the stomach or duodenum. 30 c.c. of a 25 per cent. solution were injected into the stomach. The viscosity determined twenty minutes later showed the value 608.09, as against 664.17, the normal coefficient. Thus, instead of being only 7.0 times greater than that of distilled water at 37° C., it changed after the injection to 7.7 times greater. An equally decisive change occurred after injecting 40 c.c. of a 25 per cent. solution into the